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Abstract

We analyze the second-moment properties of the components of international capital flows and their relationship to business cycle variables (output, investment, and real interest rate) in 22 industrial and emerging countries. Total inward flows are procyclical with respect to all three macro variables. Net outward flows are countercyclical with respect to output and investment in most industrial and emerging countries. Disaggregated inward flows positively comove with output in industrial countries and with investment and the real interest rate in the G7 economies. Inward foreign direct investment is the only non-procyclical type of inward capital flows (with respect to output) in the developing economies. Formal statistical tests based on nonparametric bootstrap techniques detect significant variance increases in all G7 countries' disaggregated capital flows over exogenous and endogenously estimated breaks.

JEL Classification: *E32, F21, F32, F36*

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1 Introduction

What are the cyclical properties of international capital flows? Do inward and outward flows of foreign direct investment (FDI) surge or contract with home and host countries recessions and expansions? Has the volatility of disaggregated flows increased with financial globalization and episodes of capital account liberalization? In this paper we characterize the second-moment properties of disaggregated gross international capital flows for 22 countries and provide measures of their relationship to a set of macroeconomic aggregates. Our results provide preliminary answers to these questions and a set of stylized facts useful for understanding the dynamics of capital flows across a developmentally diverse set of countries.

Empirical research on capital flows has only just begun focusing on disaggregated gross flows (see, for example, Forbes and Warnock, 2011, and Broner et al., 2010). Until recently, most empirical research on capital flows dealt with aggregate net flows across a diverse set of countries characterized by different levels of development and openness (Broner and Rigobon, 2006; Levchenko and Mauro, 2007), flows between specific country pairs, and single components of flows, such as FDI or debt. Yet, focusing on aggregate net flows obscures the potentially offsetting behavior of gross inward and outward flows, behavior that can have significantly different implications for macroeconomic conditions as well as individual industries and firms. Similarly, focusing on net flows reflects joint behavior of foreign and domestic agents, each of whom may have different motivations and incentives for their investment decisions. Until this point, there has been scant systematic analysis of the behavior of all types of capital flows at business cycle frequencies and at the cross-country level. Our work aims to fill this gap, contributing to the empirical evidence on links between the dynamics of international credit and economic activity.

Our focus is on the second-moment properties of international capital flows and on the relationship between capital flows and business cycle variables in source and destination countries. We adapt an idea originally suggested by Doyle and Faust (2005) and revisited in De Pace (forthcoming) in the context of the international business cycle literature. We use formal statistical techniques based on nonparametric bootstrap methods to test the significance of the volatility (variance) of capital flows and reference macroeconomic variables, their comovement (covariance and correlation), and their volatility and comovement

variations over exogenous and endogenously estimated breakpoints.[1]

We carefully document how aggregate gross flows and the disaggregated components of flows interact with macroeconomic variables and delineate stylized facts on the cyclical properties of disaggregated capital flows for at least three reasons. First, although we know that capital flows from industrial economies to emerging markets are more volatile than flows between industrial countries (Broner and Rigobon, 2006), there are few facts available about the volatility of the individual components of flows for a comprehensive set of industrial and emerging market countries. Understanding the second-moment and cyclical properties of capital flows may help explain why, for example, we do not observe the type of risk-sharing arrangements predicted by theoretical models or why we see so much heterogeneity in the risk-sharing experience of countries at different stages of financial development (Kose, Prasad, and Terrones, 2009). We also analyze capital flow volatility measures as volatility in financial flows can have negative consequences ranging from mild amplification of business cycles to increasing the risk of catastrophic collapse of financial systems.

Second, international capital flows can be seen as adjustments to country portfolios in response to investment decisions and exogenous shocks. Capital flows are ultimately determined by the interaction of demand and supply of financing by firms and sovereigns. By empirically characterizing the second moments of these flows, we provide a set of stylized facts that can guide the calibration of models incorporating country portfolios as well as understand how changes in the mix of flows can affect firm-financing decisions or restrict their access to capital (Devereux and Sutherland, forthcoming; Tille and van Wincoop, 2010).[2]

Third, we provide facts that could be valuable for answering policy-related questions concerning the dynamics of international capital flows following specific economic events. For example, our results provide a basis to answer questions such as: How do recessions in the G7 countries affect the volume and composition of capital flows to emerging countries? Does increasing financial development coincide with increases in the volatility of the components of capital flows? Do individual flows heighten or dampen the

[1] Other studies, such as Claessens, Dooley, and Warner (1995), consider the time-series properties of flows, such as persistence and predictability, and measure volatility using the coefficient of variation.

[2] Tille and van Wincoop (2010) theoretically show that the two most important causes of capital flow movements are portfolio growth due to time-varying expected returns and portfolio reallocation associated with time-varying second moments. However, they also note that fluctuations in second moments affect capital flows only to the extent that they affect the portfolio choices of domestic and foreign investors differently.

variation of output and investment over the business cycle?

In this work we analyze 22 advanced and emerging economies for which we have quarterly data over the period 1992-2005.[3] We truncate our sample at 2005 to exclude the financial crisis (beginning in 2007) and boom in capital flows leading up to 2007.[4] Particular attention is devoted to the G7 countries, for which we have quarterly data from 1975. We collect quarterly time series on total net flows and disaggregated gross flows and consider the ratio between each flow and gross domestic product (GDP).[5] We examine three (transformations of) macroeconomic variables: the logarithm of real GDP, the ratio between gross fixed capital formation and GDP, and the real interest rate. For each transformed macroeconomic and capital flow series we estimate cyclical and trend components using standard filtering techniques.[6] For each country we describe the evolution of the second-moment properties of their capital flows using a recursive approach. Then we test for the statistical significance of those properties and, in the case of G7 economies, we analyze their structural variations over the sample.

We find that international capital flows exhibit heterogeneous volatility properties. In most countries, debt is the most volatile type of flows, FDI the least volatile. We show that total inward flows are procyclical with respect to output, investment, and the real interest rate.[7] Net outflows, on the other hand, are countercyclical with respect to output and investment in both emerging and industrial countries. They are procyclical with respect to the real interest rate in developing countries, but countercyclical in most industrial economies (the G7 countries represent an exception in the period 1992-2005). Disaggregated inward flows are found to be procyclical with respect to output in industrial countries. Inward FDI is

[3]These countries are among the largest sources and destinations of capital flows. Advanced economies: Canada (CAN), Denmark (DEN), Finland (FIN), France (FRA), Germany (GER), Italy (ITA), Japan (JAP), Norway (NOR), Portugal, (POR), Spain, (SPA), Sweden (SWE), United Kingdom (UK), United States (US). Emerging economies: Argentina (ARG), Brazil (BRA), Indonesia (IND), Mexico (MEX), Peru (PER), Philippines (PHI), South Korea (SKO), Thailand (THA), Turkey (TUR). G7 countries: Canada, France, Germany, Italy, Japan, United Kingdom, United States.

[4]Other articles study the behavior of international capital flows during the financial crisis. For example, see Contessi and De Pace (forthcoming), Milesi-Ferretti and Tille (2011), and Tille (forthcoming)

[5]We analyze up to 12 flow series for each country: inward Foreign Direct Investment (iFDI), inward Foreign Portfolio Investment (iFPI), inward Debt (iDebt), and total inward flows (iTot); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt), and total outward flows (oTot); net total flows (noTot), defined as outward flows net of inward flows; net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined analogously. Capital flows ratios are conceptually similar to net exports-to-GDP ratios in the international business cycle literature (see Neumeyer and Perri, 2005). Samples, variables, and sources are described in Appendix A.

[6]Ideally, longer samples would prevent the well-known complications associated with the available filtering procedures. When we study the second-moment properties of capital flows and macro variables, we try to mitigate the small-sample problem by extensively using bootstrap techniques.

[7]An individual capital flow is said to be procyclical (countercyclical) with respect to a reference macroeconomic variable if the correlation coefficient of the cyclical component of the ratio between that capital flow and GDP and the cyclical component of the reference macroeconomic variable is positive (negative).

the only non-procyclical type of inward capital flows (with respect to GDP) in the emerging economies. Generally, disaggregated inward flows are also positively correlated with investment and, to a lesser extent, the real interest rate in the G7 countries. Inward debt flows are procyclical with respect to all three macroeconomic variables, with the exception of the industrialized countries in the 1992-2005 period, over which we observe negative comovement with the real interest rate and investment. Outward FDI tends to be procyclical with respect to all three macroeconomic variables in the G7. Like other similar studies (for example, Claessens et al., 1995, and, more recently, Smith and Valderrama, 2009), we caution against arguing in favor of uniform patterns in the behavior of individual types of flows, even among sets of countries in similar stages of economic development. As also shown by Milesi-Ferretti and Tille (2011), there is wide cross-country heterogeneity in the behavior of capital flows.

Finally, our analysis indicates that episodes of capital account liberalization in the G7 economies and other break dates endogenously determined are associated with statistically significant increases in capital flow volatility, but are not associated with systematic changes in correlations and covariances of the different types of capital flows with macroeconomic variables.

In Section 2, we briefly review what international capital flows are, what we know about them, and the related economic literature. In Section 3, we describe the two methods we adopt to determine the breaks and the bootstrap techniques that we apply to make inferences on comovement and variability changes. In Sections 4 and 5, we describe and discuss the main results. Section 6 concludes.

2 Background on International Capital Flows

In this section we position our paper within the literature on international capital flows and provide an argument for considering disaggregated flows.

2.1 Looking at Disaggregated Flows

Previously, lack of data availability on the details of the capital account made it difficult to consider inflows and outflows separately for a large set of countries. Past research concentrated predominantly on net inward flows – i.e., the difference between inflows and outflows. Net flows have historically been the

only form in which the components of the capital account were reported.[8] However, a few authors have argued that, by considering net flows, we may miss important nuances in the data that are likely to affect the way we interpret empirical results. For example, Rothenberg and Warnock (2006) look at gross flows and show that about half of the observed sudden stops (retreat of global investors) are actually episodes of sudden flights of local investors associated with economic slowdowns and currency depreciations. Kose et al. (2009) and Devereux and Sutherland (2009) make a similar point. They discuss emerging markets' ability to share risk and conclude that this ability could be dependent, to some extent, on the composition of flows. Other authors have made a strong case in favor of looking at gross disaggregated flows, which is now possible, given that the data series on disaggregated flows are long enough and usually available, although they may occasionally be plagued by problems of cross-country heterogeneity in data reporting and other issues.[9]

The main categories of financial flows have very different characteristics and propagate through separate markets that vary significantly in their level of organization and liquidity. Many international transactions involving financial instruments – for example, bank loans, government securities, bonds, and equity – are channeled through markets with numerous buyers and sellers, standardized contracts, and publicly available prices. The market structure often approximates perfect competition. FDI, however, is not observed in financial markets. Rather, it is the result of financial and industrial decisions, internal to the firm, that may have real implications potentially unrelated to purely financial variables. As pointed out by Lipsey (1999), "*a comparison of net direct investment flows with aggregate net international investment misses much of the significance of direct investment.*" Outward FDI flows are registered as generated by firms incorporated in the reporting country, whereas inward FDI flows represent the activity of foreign firms based in the host economy. These flows are categorized by the International Monetary Fund (IMF) as *investment abroad* and *investment in a country*, respectively.[10] On the other hand, most foreign portfolio investment (FPI) moves across organized exchanges, reflecting investors' preference for risk, diversification strategies, and portfolio biases, which may vary across countries.

[8] Even today some transactions are observable only as simultaneous flows of opposite sign, for example, purchases of short-term debt.

[9] For example, Lipsey (1999), Rothenberg and Warnock (2006), Kose et al. (2009), Contessi et al. (2012), and Contessi and De Pace (forthcoming).

[10] Investment abroad (oFDI) data can be negative when repatriation of foreign investment is larger than new investment. This issue has been observed in countries affected by financial crises. Such situations need to be treated carefully in empirical work.

2.2 Related Literature

Our work is related to two branches of economic literature. The first branch includes a growing body of studies in applied macroeconometrics and international business cycles – e.g., McConnell and Quiros (2000), Ambler et al. (2004), Heathcote and Perri (2004), Doyle and Faust (2005), Fogli and Perri (2006), and references therein – that examine changes in domestic volatility and cross-country correlation of macroeconomic aggregates. Doyle and Faust (2005) find falling volatility in macroeconomic variables for the G7 countries through formal statistical tests based on parametric bootstrap techniques, but no systematic changes in measures of cross-country comovement over time. De Pace (forthcoming) revisits their approach and describes comovement changes in international business cycles among countries in the European Union and among North American Free Trade Agreement (NAFTA) countries.

The second branch studies the determinants of international capital flows and how their volatility features are related to the performance of emerging markets in terms of growth. One strand examines the changes in price of capital – e.g., Uribe and Yue (2006), Neumeyer and Perri (2005) – and their effects on the business cycles of recipient countries. A second strand considers the variations in net capital flows and returns associated with financial integration (e.g., Broner and Rigobon, 2006, and Neumann et al., 2009). A third strand, within which financial assets and liabilities are interpreted as country portfolios, focuses on the macroeconomic implications of financial integration (e.g., Devereux and Sutherland, forthcoming; Devereux and Sutherland, 2009; and Tille and van Wincoop, 2010).

A small set of articles analyzes the cyclical properties of certain types of capital flows and provides a direct term of comparison to our work. Contessi, De Pace, and Francis (2012) use formal statistical tests and detect significant volatility increases in disaggregated capital flows over breaks in business cycle comovement among the G7 countries. They also find mixed evidence of changes in the covariances and correlations between disaggregated capital flows and a set of macroeconomic variables. Kaminsky, Reinhart, and Vegh (2005) collect yearly data for 105 economies and find that net capital inflows are procyclical in most Organisation for Economic Co-operation and Development (OECD) and developing countries. Given that disaggregated capital flows data for such a large number of countries do not exist, the authors cannot derive further results for gross flows or their disaggregated components. Pintus (2007) notes that the empirical evidence in Kaminsky et al. (2005) contradicts the standard neoclassical prediction

that countercyclical capital flows should function as conduits for international risk-sharing.[11] Kose et al. (2009) show that industrialized countries are able to achieve some modest risk-sharing. They also find that emerging markets actually experience increasing consumption volatility even as financial integration increases.[12] There may be a variety of reasons explaining the lack of international risk-sharing observed in the data. An explanation is that the relationship between financial integration and risk-sharing may be nonlinear, so that a threshold level of financial development is required before efficient risk-sharing can be achieved.

Three recent papers consider the second moments of individual flows. Levy-Yeyati et al. (2007) study the cyclical nature of *north-south* FDI.[13] They consider the United States, Europe, and Japan and find that outward FDI is countercyclical with respect to output and interest rate cycles in the United States and Europe, and mildly procyclical in Japan. They also find that FDI and local investment in the source country are negatively correlated. Using a more systematic approach, Levchenko and Mauro (2007) look at 142 countries over the 1970-2003 period and show that (a) FDI is the least volatile type of capital flow and (b) different types of flows behave differently over episodes of sudden stops, with FDI being remarkably stable. They also show that bank lending flows drop dramatically and takes a long time to recover after those episodes. Finally, Smith and Valderrama (2009) focus on emerging market countries and consider disaggregated inward flows data. They find that (a) gross capital inflows tend to be positively correlated with domestic investment, (b) the components of flows have diverse cyclical properties (debt and portfolio flows are more correlated with investment than with GDP, whereas FDI is more correlated with GDP), and (c) each type of financial flow is individually more volatile than the sum of the flows, suggesting some degree of substitutability across flows. In their paper they also construct a small open-economy model with borrowing constraints and a countercyclical financing premium to explain these stylized facts.[14]

[11] Theoretically, under the assumption of complete markets, cross-country consumption growth rates should be perfectly or highly correlated, fluctuations in consumption should be more highly correlated across countries than fluctuations in output, and the correlation of consumption growth rates with world output growth rates should be higher than with domestic output growth rates. These theoretical predictions find mixed support in the data, however. In fact, most studies find either limited risk-sharing (among industrialized countries) or none at all (for emerging market and developing countries).

[12] They suggest that this may be due to inappropriate use of capital flows to bolster current consumption growth, rather than to deepen domestic investment.

[13] They use bilateral yearly data for 22 source and 56 destination countries from the OECD *International Direct Investment Statistics* database.

[14] Another way of differentiating these flows is suggested by Goldstein and Razin (2006), who, using an agency theory approach, model the difference between FDI and FPI as a trade-off between ownership or direct management and delegation of control.

Our work fits most closely with this more recent literature. We are able to analyze disaggregated gross capital flow dynamics for a broader set of countries and focus particularly on their volatility and comovement with macro aggregates.

3 Breakpoint Analysis

Recently empirical methods have been developed to determine whether the volatility of aggregate macroeconomic variables or the comovement among them has changed over time or in correspondence to breakpoints in their time series. In this work we make inference on changes in volatility (variance) of capital flows and comovement (covariance and correlation) between flows and three reference macroeconomic variables using a nonparametric bootstrap procedure described in De Pace (forthcoming).

In general, inference on correlation coefficients and correlation changes is difficult, especially if the data are time-dependent and autocorrelated and the samples are small. In such situations, conventional asymptotics does not provide good approximations to the distributions of estimators and test statistics, making the nominal probability of rejecting a true null hypothesis and the true rejection probability very different from each other. Bootstrap techniques, used in alternative forms and under specific conditions, represent a reliable way to estimate the distribution of an estimator, to reduce its finite-sample bias, and to achieve significant asymptotic refinements in actual versus nominal coverage and size properties of confidence intervals and statistical tests, respectively.[15]

We choose two sets of breaks on the basis of two different methods. Under Method I, we impose exogenous breaks corresponding to specific economic events. Using Method II, we estimate breaks at unknown dates via recursive Chow tests applied on autoregressive models for the capital flows.

3.1 Method I: Breaks in Capital Account Liberalization Measures

We determine breaks in G7 time-series data using the changes in the liberalization indices of each country. We consider the three variables constructed by Kaminsky and Schmukler (2008) to capture liberalization in capital accounts, domestic financial markets, and stock markets.[16] Each liberalization variable may

[15] See also De Pace (forthcoming)'s technical appendix for a more detailed description of the implemented methodology and its motivation.

[16] See online appendix for further details.

take one of three possible qualitative values: no liberalization, partial liberalization, or full liberalization.

G7 countries fully liberalized their capital accounts between 1970 and 2005. Canada and Germany experienced a single episode of liberalization in the mid-1970s and the early 1980s, respectively. France, Italy, and the United States experienced two episodes each, whereas the United Kingdom had three and Japan four. Each episode corresponds to a discrete change in a liberalization index. Canada's full liberalization occurred before the beginning of our sample. The remaining six countries achieved full capital account liberalization by 1992:Q1. For the purpose of our econometric investigation, we choose a single break for each country, corresponding to its most recent liberalization episode in the capital accounts: 1991:Q4 for Japan, 1990:Q1 for France, 1981:Q1 for Germany, 1992:Q2 for Italy, 1981:Q1 for the United Kingdom (UK), and 1982:Q1 for the US. We use these dates to estimate shifts in the variances of capital flows and reference macroeconomic variables, and shifts in their correlations and covariances.

3.2 Method II: Breaks at Unknown Dates

A graphical inspection of the evolution of the volatility of disaggregated capital flows in the G7 countries – plotted in the online appendix of this paper – suggests the existence of common breaks in most economies. Most of these breaks seem to occur between the end of the last century and the beginning of the current one. We use the econometric approach that follows to formally identify breaks in the variance of the unexplained part of each capital flow in the G7 countries.

We estimate the best simple univariate $AR(K)$ model for the generic capital flow series, s_t, normalized to GDP:

$$s_t = \mu + \Sigma_{k=0}^{K} \alpha_k s_{t-k} + \varepsilon_t, \qquad \text{(CFM)}$$

where ε_t is a serially uncorrelated random error term, μ is the intercept term, and $\alpha_0 = 0$. The innovation variance of the model is $Var(\varepsilon_t) = E\left(\varepsilon_t^2\right) - [E(\varepsilon_t)]^2 = E\left(\varepsilon_t^2\right)$. We look for a break in $Var(\varepsilon_t)$ and constrain it to occur in the middle 70 percent of the sample. We run a sequence of recursive Chow tests for breakpoint estimation and use a fixed-regressor grid-bootstrap procedure to derive the first-order asymptotic distribution for the statistics of interest, as described in Appendix B, to be used to test the null of no breaks in the innovation variance versus the alternative of one break.

All significant breakpoints in the conditional variances of inward, outward, and net total flows occur

later than the latest episodes of capital account liberalization. We generally find breaks in the late 1990s and in the early 2000s. See Table 1 for a complete list of the breaks.

[Insert Table 1 about here]

3.3 Changes in Second Moments

The next sections describe the statistical methods used to test the significance of the second moments that we consider and their changes. More details are given in Appendices C and D.

3.3.1 Testing for Changes in Variance, Covariance, and Correlation

We use a version of a nonparametric bootstrap technique to test for second-moment changes in time-series pairs (covariances and correlations) or in single time series (variances). We bootstrap nonparametrically the difference between the second moments over two subsequent subsamples. The breakpoint, Br, is exogenously given (Method I) or detected through the previously described recursive procedure (Method II).

Let θ be the parameter under investigation, θ_1 its true value over the first sample, and θ_2 its true value over the second sample. In this paper, θ can be the variance, the covariance, or the correlation coefficient. We test whether the parameter shift, $\Delta\theta = (\theta_2 - \theta_1)$, is statistically significant. Formally, we consider the statistical test with size $(1-\alpha) \in (0,1)$, $H_0 : \Delta\theta = (\theta_2 - \theta_1) = 0$ against the alternative $H_1 : \Delta\theta = (\theta_2 - \theta_1) \neq 0$.

We base our statistical inference on the construction of two-sided α-level confidence intervals from the bootstrap distribution of $\widehat{\Delta\theta}$.[17] We can thus test for significant shifts and directly infer the sign of their direction. We apply the bootstrap to the data and use bootstrap iteration to estimate confidence intervals with improved accuracy.[18] That is, we derive iterated bootstrap percentile confidence intervals and iterated bias-corrected (BC) percentile confidence intervals, as described in DiCiccio, Martin, and Young (1992). We determine significant shifts at the 10 percent level as indicative of parameter instability.

[17] We always refer to two-sided equal-tailed confidence intervals. They are equal-tailed because they attempt to place equal probability in each tail.

[18] We resample blocks of random length. Length is sampled from an independent geometric distribution whose expected value equals the expected block size. The original series should be *wrapped* around a circle to fill blocks going past the last observation. Optimal expected length is estimated through an inner (smaller) bootstrap procedure. This resampling scheme is known as *stationary bootstrap*.

3.3.2 Testing for the Statistical Significance of Correlations

The same technique is used to test the statistical significance of correlations between reference macroeconomic series and capital flows. This time, we test the null hypothesis $H_0 : \theta = 0$ against $H_1 : \theta \neq 0$, where θ is the unconditional correlation between two variables. The algorithm of the bootstrap works as outlined in the previous section, with the exception that it is applied over the full sample, T, to compose the bootstrap distribution of the correlation coefficient estimator, $\widehat{\theta}$. A second round of bootstrapping (bootstrap iteration) is used to estimate the coverage error of percentile confidence intervals, construct accurate bootstrap percentile confidence intervals, and make reliable inference on θ.

4 Empirical Evidence and Results

Gross capital flows among industrialized countries expanded by 722 percent between 1991 and 2005. This increase exceeded real GDP growth (approximately 29 percent) and international trade growth (about 151 percent) in advanced economies. During those years macroeconomic comovement among the G7 economies was lower than in previous decades.[19] A formal assessment of the statistical properties of disaggregated capital flows may provide some explanation of these facts.

In this section, we describe the characteristics and the evolution of the second-moment properties of disaggregated capital flows.

4.1 Data Description

We consider 12 types of capital flow – inward FDI, FPI, debt, and total inward flows; outward FDI, FPI, debt, and total outward flows, as well as net flows – for each of the 22 countries in the sample. Our data include the G7 countries (US, United Kingdom, France, Germany, Italy, Canada, and Japan), 6 additional industrial countries (Norway, Sweden, Finland, Denmark, Spain, and Portugal), and a set 9 of emerging market countries (Argentina, Brazil, Indonesia, Mexico, Peru, Philippines, South Korea, Thailand, and Turkey). These countries provide a good sample of source and destination countries for the majority of capital flows.

We use quarterly data from 1975 through 2005 for the G7 countries. Due to data limitations, we are

[19] See Heathcote and Perri (2004) and Stock and Watson (2005).

restricted to quarterly data from 1992 through 2005 for the remainder of the countries. This time frame is broad enough to capture two periods of significant increases in capital flows (1992-99 and 2001-05), as well as the Asian crisis, although our analysis is not specifically about crisis periods. A more detailed description of the data is available in Appendix A and the online appendix.

4.2 Rolling Standard Deviations of Capital Flows

In the online appendix of this paper we plot 5-year rolling standard deviations for total and disaggregated capital flows normalized by GDP. The volatilities of both inward and outward FDI and FPI in the G7 countries exhibit an increasing trend that generally begins in the mid-1990s. Some peaks occur in the late 1990s and early 2000s. The volatilities of disaggregated flows follow an inverted-U shape in the second part of the sample in almost all cases. This peculiar evolution is probably due to the boom and subsequent slowdown in the flows occurred in the late 1990s and early 2000s. Total inward and outward flows in the G7 countries are dominated by movements in debt and their volatility increases over the years in most cases. The volatility of inward flows is larger than that of outward flows in most emerging economies. Net flows are predominantly negative and their volatility appears to be driven by that of inward flows. Debt flows have higher volatilities than other flows in all countries.

Furthermore, the graphical analysis confirms some established facts in the empirical literature on capital flows. (a) Net capital flows exhibit a slightly increasing trend in most G7 countries, with the exception of the United States, where they trend downward. (b) Net flows in the rest of the advanced and emerging market economies are usually negative. (c) The volatility of net total flows is lower than that of both total inward and outward flows in most G7 countries, but this is not the case, in general, in the other advanced and emerging market countries. (d) FDI is the most stable flow in most advanced countries.

4.3 Correlations with Business Cycle Variables

We discuss the correlations between the cyclical components of capital flows and the cyclical components of three reference macroeconomic variables – the logarithm of GDP, the ratio between gross fixed capital formation and GDP, and the real interest rate. Results are reported in Figures 1 through 3 and Tables 2 through 10.

4.3.1 Backward Recursive Correlations

In our first step in evaluating the relationship between the cyclical components of capital flows and macroeconomic variables we use a graphical approach. We estimate the correlations between capital flows and output and investment over the samples 1975-2005, 1981-2005, 1986-2005, 1996-2005, and 2001-05. The corresponding graphical representations (Figures 1, 2, and 3) allow us to assess the time evolution of the correlations and observe their dynamics in the years during which financial globalization intensified and international business cycles exhibited breaks (Doyle and Faust, 2005; Stock and Watson, 2005).

[Insert Figure 1 about here]

[Insert Figure 2 about here]

[Insert Figure 3 about here]

Based on our graphical analysis, we find few significant patterns, thus it is difficult to make an overall statement about either the signs of the correlations or their dynamics over time. The only set of countries with a clear general pattern is the G7. Inward and outward FDI and FPI became increasingly positively correlated (procyclical) with real GDP in most G7 countries while correlations with debt appeared to have no trend. For the other OECD and emerging market countries a definite pattern is lacking as there is a great deal of heterogeneity in the sign of the correlations, which frequently switches over the sample in most cases. In this respect, the other OECD countries are more similar to emerging market countries than the G7. The patterns for the G7 are likely due to their increasingly close trade relations and the relative synchronicity of their business cycles, which may explain why Japan seems to differ from the rest of the G7.

4.3.2 Correlations over the Full Samples

The correlations between the cyclical components of the disaggregated capital flows and the cyclical components of real GDP, investment to GDP ratio, and the real interest rate are reported in Tables 2 through 10. Figures in bold are significantly different from zero at least at the 10 percent level.[20] We consider the 1992-2005 period for all countries; in the case of the G7 countries, for which longer series are available,

[20]The nonparametric bootstrap described above is also applied here to test for the statistical significance of the correlation coefficients.

we also compute the correlations over the 1975-2005 and 1975-92 periods. To determine if a particular flow is procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark), over the sample and with respect to a reference macroeconomic variable, we use a simple rule of thumb: (a) we report + (or -) if there are significant correlations and the majority of them are positive (or negative); in this case the flow is procyclical (or countercyclical); (b) we report ?/+ (or ?/-) if the number of significantly positive correlations is the same as the number of significantly negative correlations and the majority of the nonsignificant correlations are positive (or negative); (c) we report ? in all other cases. What follows is a summary of the main findings for each type of flow.

Aggregate Flows. (1A) Inward flows are procyclical in the G7, other industrial countries, as well as emerging market countries with respect to GDP and investment. They are also procyclical with respect to the real interest rate in all industrial countries, but possibly countercyclical in emerging market countries. (1B) Outward flows are procyclical with respect to investment in industrial countries and also with respect to GDP in industrial countries outside the G7, where they are potentially countercyclical. In emerging market countries outflows are countercyclical with respect to GDP, investment, and real interest rate. (1C) Net outflows are countercyclical with respect to GDP and investment in both emerging and industrial countries, including those in the G7. They are procyclical with respect to the real interest rate in emerging market countries, but countercyclical in most industrial countries (with the exception of the G7 in the period 1992-2005).

[Insert Table 2 about here]

[Insert Table 5 about here]

[Insert Table 8 about here]

Disaggregated Flows. (2A) Inward flows are procyclical in industrial countries with respect to GDP. Inward FDI is the only non-procyclical type of inward capital flows (with respect to GDP) in the emerging economies. Inward flows are, in general, positively correlated with investment and, to a lesser extent, the real interest rate in the G7 countries. Inward debt flows, in particular, are procyclical with respect to all three macroeconomic variables, with the exception of the industrialized countries in the 1992-2005 period,

over which we observe negative comovement with real interest rate and investment. (2B) Outward FDI tends to be procyclical with respect to all three macroeconomic variables in the G7 economies. (2C) The cyclical properties of net disaggregated flows with respect to macroeconomic variables are heterogeneous and there is no observable pattern.

[Insert Table 3 about here]

[Insert Table 4 about here]

[Insert Table 6 about here]

[Insert Table 7 about here]

[Insert Table 9 about here]

[Insert Table 10 about here]

The significant heterogeneity in the cyclical characteristics of capital flows warrants more careful study and casts doubt on whether stylized facts can actually be determined across countries, groups of countries, and periods of time.

4.4 Shifts in Second Moments

In Tables 11 and 12 we report the qualitative statistical inferences that we make on the changes in the variance of capital flows and macroeconomic variables, and on the changes in correlation and covariance between them in the G7 countries. Breakpoints are imposed using the two methods described in Sections 3.1 and 3.2. We individually test for correlation, covariance, and variance changes to identify the specific sources of comovement variations. Changes in the covariance can be interpreted as changes in the total common variation of capital flow and reference macroeconomic variable. Changes in the variance can, instead, be seen as variations in the total volatility properties of either capital flow or the reference macro variable. A part of the total variation depends on the variability of the idiosyncratic shocks, the remaining part depends on the variability of the common shocks. From this point of view, the correlation coefficient can be intuitively interpreted as the share of variation that is common.

[Insert Table 11 about here]

[Insert Table 12 about here]

Most variance shifts in GDP are negative. Many of these changes are significant at the 10 percent level. Such negative variations are likely linked to the Great Moderation, the fall in the variability of real output and the reduction in the magnitude of economic shocks that occurred in the G7 and other industrialized countries roughly in the mid-1980s.[21] Most variance changes are negative and significant also for investment and the real interest rate.

Variance Changes. Variances generally increase over the breaks for net, total, and disaggregated flows. The large majority of these changes are statistically significant. This finding is consistent with previous evidence in the empirical literature and might suggest the existence of an underlying common factor affecting the volatility properties of the capital flows across the countries. The possibility of the existence of such a factor would not emerge, however, if we considered only net flows (as in Kaminsky et al., 2005), for which case, in fact, we observe less significant changes and several negative variations.

Correlation and Covariance Changes. These results are more heterogeneous. In general, we cannot identify specific patterns. Pointwise, covariance changes usually have the same sign as correlation changes, with relatively few exceptions. Furthermore, the proportion of significant switches is modest.

5 Discussion of the Main Results

Simple economic theories on capital flow movements suggest that, among industrialized countries, both inward and outward aggregate flows should be procyclical with respect to GDP and investment, reflecting portfolio diversification strategies and increasing financial globalization. We expect that total outward flows would be countercyclical with respect to output in emerging market countries, potentially due to capital flight during recessions. Our expectations are largely met. In the G7, inward and outward flows are both procyclical with GDP, the investment ratio, and the real interest rate. We expect that outward flows would be countercyclical with respect to the real interest rate, while inward flows would be procyclical, reflecting the reallocation of capital from countries with low marginal products to those with

[21] With positive covariances between GDP and other capital flows, a decrease in the idiosyncratic variability of GDP may be a source of increased correlations with the flows. The net effect on the correlation coefficients also depends on the sign and size of the changes in the total variance of capital flows and on the variations of their common variability with GDP, as measured by the covariance.

high marginal products, ceteris paribus. Yet, we also observe a countercyclical relationship between real interest rates and inward flows in emerging market countries, which is contrary to our expectations. We conjecture that, in the case of emerging market countries, high real interest rates, while reflecting capital scarcity, may also reflect macroeconomic instability that inhibits the cross-border reallocation of capital.

Where the cyclical properties of capital flows differ between the G7 and other industrial countries, we speculate that the documented dissimilarities might be driven by the structural differences between the two groups of countries in the sample. On the one hand, we have tighter similarities among the G7, with their strong trading relationships and the depth of their financial markets. On the other hand, the remaining industrialized countries we analyze have little obvious relationship with one another, although some of them – Spain and Portugal, for example – might exhibit more similar capital flows to the G7 economies over time because of their membership in the European Economic and Monetary Union. In general, however, one should consider the fact that there is a serious lack of robust theories about the determinants of capital flows (see Tille and van Wincoop, 2010, for some discussion), which makes the interpretation of heterogeneous results difficult.

As far as the disaggregated flows are concerned, we can, instead, tie several of our stylized facts to theoretical results. First, we find that inward capital flows are generally procyclical, a fact that appears to be driven by generally procyclical inward debt flows in most countries. Such a result is intuitive, given that private debt financing is typically procyclical at the firm level (see Covas and Haan, 2011, for details). More specifically, we observe that inward FDI flows tend to be countercyclical with respect to output in emerging market economies, whereas outward FDI flows tend to be procyclical with respect to all three macroeconomic variables in the G7 economies. Three potentially interrelated reasons might explain the countercyclicality of inward FDI flows in developing countries. First, the countercyclical flows may be due to fire-sale opportunities arising from currency devaluations and lack of access to credit faced by domestic firms during recessions and financial crises. Previous empirical work based on micro data at the firm level (Aguiar and Gopinath, 2005) suggests a positive relationship between the lack of liquidity in the domestic economy and the frequency of foreign acquisitions.

Second, countercyclical inward FDI may arise from the interaction between information asymmetry and the need for liquidity.[22] If projects have different productivity levels and returns, investors may

[22]See Goldstein and Razin (2006), Kirabaeva (2009), and Kirabaeva and Razin (2009).

liquidate a project due to either low productivity or temporary liquidity problems that a potential (foreign) buyer with limited information cannot distinguish. Therefore, in countries with liquidity shocks inward FDI may increase relative to FPI because it provides superior private information about productivity through direct managerial control. Thus, a liquidity shock associated with a deep recession raises the probability that foreign investors will enter the domestic market through direct investment rather than portfolio investment.

Third, the countercyclicality of FDI in emerging market economies may depend on changes in the valuation of domestic firms over the business cycle (Razin and Sadka, 2007). Smith and Valderrama (2009) show that, when multinationals face search costs to identify target firms, inward FDI becomes a function of the wedge between foreign and domestic valuation of a host country firm. When domestic firms are more financially constrained than multinationals, their value to foreign firms with access to cheaper credit increases, inducing multinationals to intensify the search. Currency depreciations, when they occur in a context in which a country's macroeconomic fundamentals remain relatively strong, reduce the price of domestic firms for foreign buyers.

The time period we consider contains a number of large devaluations and depreciations, along with periods of low liquidity, in the developing countries. A few examples are the Mexican peso crisis of 1994-95, Argentina's currency crises of 1994 and 2001, Brazil's devaluation of the real in 1999, the East Asian crisis of 1997-98, and Turkey's 2001 currency collapse. During these sharp currency corrections, with the exception of the Argentine and Turkish crises in 2001, industrial countries, particularly the United States and the United Kingdom, were experiencing prolonged economic expansions. The precipitous drop in the domestic valuation of local firms in these emerging market countries made acquisition more appealing for foreign investors. The countercyclical FDI inflows that we detect in the emerging economies could, in principle, be explained by the theoretical frameworks described above.

We also look at the changes in the second-moment properties of capital flows in the G7 economies over exogenous and endogenously estimated breakpoints. According to standard international business cycle theories, deeper financial integration should allow capital to flow to countries with positive productivity shocks and to those that grow faster. The theoretical consequences would be lower synchronization among net capital outflows and output, lower GDP correlations, increased risk-sharing at the international level, and higher volatility in all capital flows (Kydland, 1992; Backus et al., 1992).

On the one hand, the data and the statistical methodology used to detect statistically significant variations suggest that little change has occurred so far. We do not find evidence of significant systematic changes in the comovement of flows with the reference macroeconomic variables. We cautiously suggest that increasing financial globalization, where episodes of capital account liberalization occurred between the 1980s and the early 1990s, as well as the estimated breaks in the conditional variance of the capital flows (which occur much later) are not associated with changes in the cyclical behavior of capital flows in the G7. The heterogeneous correlation changes can be explained by the generally increasing volatility of capital flows (very often in statistical terms), the contemporaneous decreases in the total variation of the macroeconomic variables, and the nonhomogeneous covariance variations between macro aggregates and capital flows.

On the other hand, statistically more volatile capital flows are often evidence of more pronounced integration in financial markets. However, other studies have not found evidence of increased risk-sharing among G7 countries in the form of higher consumption correlations.[23] The positive variations in the variance of capital flows may also imply an increase in external financial shocks in the G7 countries. Yet, the mixed results on covariance and correlation changes and their small estimates also suggest that this might not be the case.

Finally, we show that total net outflows possibly become more procyclical with respect to GDP and the other two macro variables after the breaks, consistent with previous empirical findings of little or no increase in risk-sharing.

6 Conclusion

We derive stylized facts for the second-moment properties of the components of international capital flows and describe their relationship (covariance and correlation) to macroeconomic variables in 22 source and destination emerging and advanced countries.

Capital flows exhibit heterogeneous volatility properties: In most countries, debt is the most volatile type of flows, FDI the least volatile. We also show the following facts. (a) Total inward flows are procyclical with respect to output, investment, and, to a lesser extent, the real interest rate. (b) Net outflows are

[23] For example, see Doyle and Faust (2005), but also De Pace (forthcoming).

countercyclical with respect to output and investment in both emerging and industrial countries, including those in the G7. They are procyclical with respect to the real interest rate in emerging market countries, but countercyclical in most industrial countries (with exception of the G7 in the period 1992-2005). (c) Disaggregated inward flows are procyclical with respect to GDP in industrial countries. Inward FDI is the only non-procyclical type of inward capital flows (with respect to GDP) in the emerging economies. Disaggregated inward flows are also, in general, positively correlated with investment and, to a lesser extent, the real interest rate in the G7 countries. Inward debt flows, in particular, are procyclical with respect to all three macroeconomic variables, with the exception of the industrialized countries in the 1992-2005 period, over which we observe negative comovement with real interest rate and investment. (d) Outward FDI tends to be procyclical with respect to all three macroeconomic variables in the G7 economies.

We run formal statistical tests to make inferences on the variations of volatility, covariance, and correlation between capital flows and a set of macroeconomic variables in the G7 countries. Second-moment shifts are mixed in sign over episodes of capital account liberalization and breakpoints in the conditional variance of the individual capital flows. However, we detect a clear and statistically significant increase in the variance of all types of flows.

While recent theoretical papers model the link between business cycles and the dynamics of capital flows, there still seems to be substantial uncertainty about the stylized facts. Our comprehensive assessment of the second-moment properties of disaggregated capital flows provides a benchmark set of results useful for further theoretical and empirical work in this area.

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Appendix

A Data

Capital Flows. We collect quarterly data from 1975:Q1 to 2005:Q4 for the G7 countries. Because of data unavailability, the sample is restricted to the 1992:Q1-2005:Q4 period in the case of the remaining 15 countries. If available, the data are taken from *International Financial Statistics* (IFS), published by the IMF. We use quarterly nominal GDP from the IFS to normalize capital flow series. Quarterly GDP is reported in national currencies. We convert national currencies into U.S. dollars using end-of-period market exchange rates (also reported in the IFS). For the euro-area countries, we use the national currencies (franc, deutsche mark, and lira) until the introduction of the euro (January 1, 1999). For the period between 1999 and 2005 we use fixed national currency factors to determine the euro rate. We collect FPI, FDI, and other investment flows for each of the G7 countries from the IFS. Assets (outflows) and liabilities (inflows) are reported separately.

Foreign Direct Investment. Inflows represent direct investment in the reporting economy – n.i.e., line 78bed, IFS; outflows represent direct investment abroad (line 78bdd). FDI includes equity capital, reinvested earnings, other capital, and financial derivatives associated with various intercompany transactions between affiliated companies (IFS June 2007).

Foreign Portfolio Investment. Inflows represent portfolio investment liabilities – n.i.e., line 78bgd, IFS; outflows represent portfolio investment assets (line 78bfd). Portfolio investment includes financial securities of any maturity, including corporate securities, bonds, notes, and money market instruments, other than those included in direct investment or reserve assets. Portfolio investment is reported in IFS data as combined debt and equity portfolio investment. It can be separated into equity securities and debt securities. Equity securities assets (line 78bkd) and equity securities liabilities (line 78bmd) include shares, stock participation, and similar equity investments (e.g., American depository receipts and global depository receipts). Debt securities assets (line 78bld) and debt securities liabilities (line 78bnd) include bonds, debentures, notes, and money market or negotiable debt instruments.

Other Investment. Inflows are other investment liabilities (line 78bid, IFS); outflows are other in-

vestment assets (line 78bhd, IFS) and include all financial transactions not covered in direct investment (FDI), portfolio investment, financial derivatives, or other assets. This category consists of trade credits, loans, transactions in currency and deposits, and other assets/liabilities.

Total Equity. Flows are calculated as equity securities + foreign direct investment, for both inflows (liabilities) and outflows (assets), to create total equity liabilities and total equity assets.

Total Debt. Flows are calculated as debt securities + other investment, for both inflows (liabilities) and outflows (assets) to create total debt liabilities and total debt assets.

Total Flows. They include total equity flows plus total debt flows. They are separated into total inflows (liabilities) and total outflows (assets). Hence, net total flows are decomposed as follows:

Type	Component	
Foreign Direct Investment	FDI	} Total Equity
Foreign Portfolio Investment	Equity	
	Debt	} Total Debt
Other Investment	Other Debt	

We remove the few outliers for which we have anecdotal evidence indicating an extraordinary individual quarterly flow. We substitute those outliers with 5-year moving averages of the flow, centered around the quarters where the abnormal flows are registered.

Liberalization Variables. The financial liberalization variable in Kaminsky and Schmukler (2008) is the mean of the liberalization measures for the capital accounts, the domestic financial markets, and the stock markets of each country. Each measure may take one of three possible qualitative values: no liberalization, partial liberalization, or full liberalization. In their article, these qualitative values are coded numerically and averaged across the three areas to give a single numerical level of financial liberalization for each country. See the online appendix of this paper for further details on the definitions of each liberalization level.

National Accounts Data, Interest Rates, and Inflation Measures. We use quarterly data from the Quarterly National Accounts (QNA) of the Organisation for Economic Co-operation and Development (OECD) on Gross Domestic Product and Gross Fixed Capital Formation, compiled according to the 1993 System of National Accounts, when available. If the time series are not long enough, we splice the OECD series with the Doyle and Faust (2005) dataset, constructed with OECD-QNA series. Data for the period from 1975:Q1 to 1977:Q4 come from the same paper. To splice the data and construct a full series backward, we use quarterly growth rates over the earlier observations of the sample. For Germany, we use quarterly growth rates of West German GDP and investment up to 1991:Q1, when reunification occurred. After reunification, we use data on the unified country, using the splicing method described in Doyle and Faust (2005) to retain consistency.

Other Data. Other data are obtained from the following sources (base years in brackets). Real GDP, Nominal and Real Gross Fixed Capital Formation : (i) OECD-QNA Chained Price index: Canada (1997), Germany (2000), Italy (2000), Japan (2000), United Kingdom (2003), Denmark (2000), Finland (2000), Norway (2003), Portugal (2000), Spain (2000), Sweden (2000). (ii) OECD-QNA: Korea (2000 won), Mexico (1993 pesos). (iii) OECD Main Economic Indicators (OECD-MEI): Brazil (2000), Indonesia (2000). (iv) IFS: Argentina (1993), Peru (1994), Philippines (1985), Thailand (1988), Turkey (1995). (v) Institut National de la Statistique et des tudes conomiques (INSEE) Chained Price index: France (1980). (vi) Bureau of Economic Analysis (BEA) Chained Price index: USA (2000). Nominal interest rates and inflation measures are from the IFS: Overnight Money market rate (Canada, United Kingdom), Call Money rate (France, Germany), Money market rate (Italy, Japan), Federal Funds Rate (USA), Consumer Price Index (CPI)-All items (Germany, Italy, Japan, United Kingdom), CPI-All cities over 30,000 (Canada), CPI-108 cities (France), CPI-All items city average (USA).

B Method II: Breaks at Unknown Dates

The technical details that we report in this appendix are also described in the online technical appendix of De Pace (2012) (available at http://sites.google.com/site/pierangelodepace/).

We estimate the best simple univariate $AR(K)$ model for the generic series, s_t:

$$s_t = \mu + \Sigma_{k=0}^{K} \alpha_k s_{t-k} + \varepsilon_t, \tag{CFM}$$

where ε_t is a serially uncorrelated random error term, μ is the intercept term, and $\alpha_0 = 0$. The innovation variance is $Var(\varepsilon_t) = E\left(\varepsilon_t^2\right) - [E(\varepsilon_t)]^2 = E\left(\varepsilon_t^2\right)$. To detect a one-time structural break at an unknown date in the variability of ε_t, we allow for a specific form of heteroskedasticity. In general, $E\left(\varepsilon_t^2\right) = E\left(\varepsilon_t^2 | z_t\right) = \sigma^2 + z_t'\alpha$, where z_t is an exogenous variable. Therefore, $\varepsilon_t^2 = \sigma^2 + z_t'\alpha + \left[\varepsilon_t^2 - E\left(\varepsilon_t^2 | z_t\right)\right] = \sigma^2 + z_t'\alpha + v_t$, with $E(v_t | z_t) = 0$. We assume that heteroskedasticity, if any, takes the form:

$$E\left(\varepsilon_t^2 | z_t\right) = \gamma_0 + D_t\gamma_1, \tag{HE}$$

where D_t is a dummy variable that controls for the shift in the innovation variance, γ_0 and γ_1 are two constants to be estimated. D_t is a vector of T observations – where T is the sample size – that contains 0s until a structural break is detected and then contains 1s in the remaining part of the sample.

We regress $\widehat{\varepsilon}_t^2$ from (CFM) on a constant and then test for the presence of a structural shift in the intercept term using a sequence of breakpoint Chow tests at different dates. We constrain the potential break to occur in the middle 70 percent of the sample. The null of the Chow test is no structural breaks. Chow-test statistics above the corresponding critical value show that the null can be rejected and that at least a one-time structural break is likely to be present. Through a sequence of breakpoint Chow tests run at different subsequent dates, we derive the possible time intervals within which the break may be found. The maximal statistics determine individual dates in correspondence to which the probability of a one-time break is maximized.

However, the critical values produced by this recursive approach are not always reliable, unless some very restrictive conditions are met. Let F_t be the F (Wald) statistic of the breakpoint Chow test at time t. Then consider three statistics, for which exact asymptotic theory exists: (a) $\sup F = \sup_{t \in [t_1, t_2]} F_t$ (Quandt/Andrews), (b) $\exp F = \ln\left[\int_{t_1}^{t_2} e^{\left(\frac{F_t}{2}\right)} dw_t\right]$ (Exponentially-Weighted F), and (c) ave $F = \int_{t_1}^{t_2} F_t dw_t$ (Average F), where w_t is a measure that puts weight $\frac{1}{t_2 - t_1}$ on each integer t in the interval $[t_1; t_2]$, t_1 and t_2 representing the boundaries of the time interval along which the sequence of Chow tests

is executed. We usually set $t_1 = 0.15T$ and $t_2 = 0.85T$.[24] Hansen (1999) develops a *fixed-regressor grid-bootstrap* procedure to derive the first-order asymptotic distribution for these statistics.[25] His grid-bootstrap allows for arbitrary structural changes in the regressors, including simple structural shifts, as in the case described in this work, as well as for lagged dependent variables and heteroskedastic errors. Probability levels for each statistic are computed following Hansen's indications and by using Monte Carlo simulations. The grid-bootstrap approach returns the same estimated breakpoint date as in the sequence of breakpoint Chow tests and either confirms or rejects (in a statistical sense) the findings of the naïve procedure based on the incorrect critical values.

C Constructing Bootstrap Distributions

In the simple case of two countries, A and B, let $X_{A,t} = \{X_{A,s}\}_{s=1}^{T}$ and $X_{B,t} = \{X_{B,s}\}_{s=1}^{T}$ denote two observed time series, with Br being an exogenous breakpoint between the first and the Tth observation. Each series is thus split into two subsamples, $X_{A,t}^1 = \{X_{A,s}\}_{s=1}^{Br}$, $X_{B,t}^1 = \{X_{B,s}\}_{s=1}^{Br}$, $X_{A,t}^2 = \{X_{A,s}\}_{s=Br+1}^{T}$, and $X_{B,t}^2 = \{X_{B,s}\}_{s=Br+1}^{T}$. Let θ be either the correlation coefficient or the covariance. In the first subsample, let $w_{A,i,l}$ and $w_{B,i,l}$, respectively, denote the blocks $\left\{X_{A,s}^1\right\}_{s=i}^{i+l-1}$ and $\left\{X_{B,s}^1\right\}_{s=i}^{i+l-1}$ of length l starting at $X_{A,i}^1$ and $X_{B,i}^1$, with $X_{A,i}^1 = X_{A,1+\{(i-1) \bmod Br\}}^1$, $X_{B,i}^1 = X_{B,1+\{(i-1) \bmod \ Br\}}^1$, $X_{A,0}^1 = X_{A,Br}^1$, and $X_{B,0}^1 = X_{B,Br}^1$. Finally, let $I_1, I_2, ...$ be a stream of random numbers uniform on the integers $1, ..., Br$, and let $L_1, L_2, ...$ be a stream of random numbers independently drawn from a geometric distribution, $Prob\,(L = l) = \lambda\,(1-\lambda)^{l-1}$ with $l = 1, 2, ...$ The inverse of λ is the expected block length, $E\,(L) = \frac{1}{\lambda}$, to be estimated through an inner procedure based on an automatic rule that minimizes an appropriate objective function. Given $\widehat{\left(\frac{1}{\lambda}\right)}$, the algorithm that generates a couple of stationary bootstrap time series replicates over the first subsample, $X_{A,t}^{1*}$ and $X_{B,t}^{1*}$, runs as follows: (i) set $X_{A,t}^{1*} = w_{A,I_1,L_1}$, $X_{B,t}^{1*} =$

[24] The $\exp F$ statistic is optimal against distant alternatives, whereas the *ave* F statistic is optimal against very local alternatives. Hansen (1999) and Hansen (2000) refine the method of Andrews and Ploberger (1994) by showing that their statistics may vary with structural changes in the regressors of the test equation.

[25] Hansen (1999) proposes a *grid-bootstrap* method to construct confidence intervals with improved performance over conventional bootstrap methods when the sampling distribution depends on the parameter. The basic idea is to calculate the bootstrap distribution over a grid of values for the parameter of interest and form the confidence interval by the no-rejection principle. This framework applies well to autoregressive models, where it is known that conventional bootstrap methods fail to provide correct first-order asymptotic coverage when an autoregressive root is close to unity. In contrast, the grid bootstrap is first-order correct globally in the parameter space. The bootstrap treats all the regressors as exogenous even when they contain lagged values of the dependent variable. Hansen (1997) derives asymptotic distributions for all three statistics. The two methods return identical results for the tests executed in this section.

w_{B,I_1,L_1}, and $j = 1$; (ii) while $length\left(X_{A,t}^{1*}\right) < Br$, increment j by 1 and redefine $X_{A,t}^{1*}$ and $X_{B,t}^{1*}$ as $X_{A,t}^{1*} := X_{A,t}^{1*} \cup w_{A,I_j,L_j}$ and $X_{B,t}^{1*} := X_{B,t}^{1*} \cup w_{B,I_j,L_j}$; (iii) if $length\left(X_{A,t}^{1*}\right) > Br$, discard the two series of pseudo-data just generated and restart resampling from (i) after drawing new streams of I_j's and L_j's. We apply this scheme to both the first and the second subsamples N_O^B times. At each complete resample of the original data, we estimate and collect $\widehat{\Delta\theta}^* = \left\{\widehat{\theta}\left(X_{A,t}^{2*}, X_{B,t}^{2*}\right) - \widehat{\theta}\left(X_{A,t}^{1*}, X_{B,t}^{1*}\right)\right\}$ to compose the bootstrap distribution of $\widehat{\Delta\theta}$. The same logic, with just one country and one time series, applies if the statistic of interest is the variance.

D Estimating Accurate Confidence Intervals

The following notation applies to the case of either correlations or covariances; by extension, it is also applicable to the case of variances, if only one time series is considered. Let $X_{A,t}$ and $X_{B,t}$ be two variables and $I_0\left(\alpha; X_{A,t}, X_{B,t}; X_{A,t}^*, X_{B,t}^*\right)$ the uncorrected bootstrap percentile confidence interval of nominal coverage probability α for $\Delta\theta$. $X_{A,t}^*$ and $X_{B,t}^*$ are two generic resamples with replacement from $X_{A,t}$ and $X_{B,t}$. I_0 is constructed from sample and resample information. Usually, in empirical applications, the coverage probability of I_0 – namely, $P(\alpha) = Prob\left\{\Delta\theta \in I_0\left(\alpha; X_{A,t}, X_{B,t}; X_{A,t}^*, X_{B,t}^*\right)\right\}$ – differs from α. There exists a real number, ϱ_α, such that $P(\varrho_\alpha) = \alpha$.

Let $I_0\left(\alpha; X_{A,t}^*, X_{B,t}^*; X_{A,t}^{**}, X_{B,t}^{**}\right)$ be a version of $I_0\left(\alpha; X_{A,t}, X_{B,t}; X_{A,t}^*, X_{B,t}^*\right)$ computed using information from $X_{A,t}^*$, $X_{B,t}^*$, $X_{A,t}^{**}$, and $X_{B,t}^{**}$; $X_{A,t}^{**}$ and $X_{B,t}^{**}$ are resamples with replacement of $X_{A,t}^*$ and $X_{B,t}^*$. An estimate of $P(\alpha)$ is

$$\widehat{P}(\alpha) = Prob\left\{\widehat{\Delta\theta} \in I_0\left(\alpha; X_{A,t}^*, X_{B,t}^*; X_{A,t}^{**}, X_{B,t}^{**} | X_{A,t}, X_{B,t}\right)\right\}.$$

Let N_O^B be the number of bootstrap replications at the outer level of resampling; then $\widehat{P}(\alpha)$ is calculated as

$$\widehat{P}(\alpha) = \left(\sum_{n_O^B=1}^{N_O^B} 1\left\{\widehat{\Delta\theta} \in I_{0,n_O^B}\left(\alpha; X_{A,t}^*, X_{B,t}^*; X_{A,t}^{**}, X_{B,t}^{**}\right)\right\}\right) / N_O^B.$$

Since distribution information on $X_{A,t}^{**}$ and $X_{B,t}^{**}$ given $X_{A,t}^*$ and $X_{B,t}^*$ is unavailable, an inner level

of resamples (say, N_I^B resamples for each outer resample,[26] n_O^B) from $X_{A,t}^*$ and $X_{B,t}^*$ is used to outline the features of that distribution.[27] The bootstrap estimate for ϱ_α is the solution, $\widehat{\varrho}_\alpha$, to the equation $\widehat{P}(\varrho_\alpha) = \alpha \therefore \widehat{\varrho}_\alpha = \widehat{P}^{-1}(\alpha)$.[28] The iterated bootstrap confidence interval for $\Delta\theta$ is then $I_1\left(\widehat{\varrho}_\alpha; X_{A,t}, X_{B,t}; X_{A,t}^*, X_{B,t}^*\right)$.

Tables and Figures

Table 1: Breaks in the Conditional Variance of Capital Flows (Method II)

Country	iFDI	oFDI	iFPI	oFPI	iDebt	oDebt	iTot	oTot	noTot
Canada	2001:Q1	1998:Q3	2000:Q1	2000:Q1	1996:Q4	1996:Q2	1996:Q4	1999:Q1	(2000:Q3)
France	1999:Q3	1999:Q2	1999:Q2	1997:Q3	1998:Q4	1997:Q4	1998:Q4	1998:Q4	2000:Q3
Germany	1998:Q1	1998:Q1	2000:Q1	1999:Q4	2001:Q1	2001:Q1	2000:Q1	1998:Q3	(1999:Q1)
Italy	2000:Q1	1999:Q2	1997:Q3	1998:Q1	1999:Q4	1992:Q3	2001:Q1	1992:Q4	(1991:Q2)
Japan	1999:Q2	1998:Q3	1997:Q4	1997:Q2	1997:Q4	1997:Q1	1997:Q2	1997:Q2	2001:Q2
UK	1999:Q2	1998:Q4	1998:Q4	1998:Q2	1998:Q4	1998:Q4	1998:Q4	1998:Q4	(1993:Q4)
USA	1998:Q4	1999:Q1	1997:Q2	1997:Q4	1996:Q3	2000:Q1	1996:Q4	2001:Q1	1995:Q3

Notes. Breaks in parentheses are not significant at the 5 percent level. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt), and total inward flows (iTot); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt), and total outward flows (oTot); net total flows (noTot), defined as outward flows net of inward flows.

[26] We use $1,000$ replications for the outer bootstrap; 500 for the inner bootstrap. There exists a serious trade-off between number of resamples and computation time that must be taken into account.

[27] Bootstrap samples are drawn using the same nonparametric method in the main and nested bootstraps.

[28] With discrete variables and discrete bootstrap distributions, an exact solution for this equation cannot always be found unless we use smoothing techniques. We choose the smallest value $\widehat{\varrho}_\alpha$ such that $\widehat{P}(\widehat{\varrho}_\alpha)$ is as close as possible to α, i.e., such that $\left|\widehat{P}(\varrho_\alpha) - \alpha\right|$ is minimized over a grid of values and additional conditions defining tolerance are satisfied. Refer to De Pace (forthcoming) and the related Companion Technical Appendix for further information on the solving algorithm and on the other estimation procedures adopted in this paper.

Table 2: Correlations with GDP (1)

		iTot	oTot	noTot			iTot	oTot	noTot
1975-2005	Canada	**0.27**	**0.16**	-0.17	**1992-2005**	Canada	0.14	0.15	0.03
	France	**0.18**	**0.14**	-0.08		France	0.17	0.17	0.05
	Germany	0.07	0.04	-0.05		Germany	0.06	-0.02	**-0.18**
	Italy	0.09	0.02	**-0.19**		Italy	-0.06	-0.11	-0.14
	Japan	-0.05	-0.09	-0.07		Japan	-0.08	-0.08	-0.01
	UK	**0.06**	0.04	-0.11		UK	0.03	0.03	0.02
	USA	0.11	-0.01	**-0.20**		USA	0.24	0.13	-0.20
						Denmark	0.08	-0.08	-0.02
Positive	**G7**	6	5	0		Finland	0.07	-0.08	0.04
Negative	**G7**	1	2	7		Norway	-0.07	-0.02	0.15
Average	**G7**	0.10	0.04	-0.13		Portugal	**0.22**	**-0.15**	-0.17
		+	+	-		Spain	0.17	-0.15	-0.04
						Sweden	0.08	0.00	-0.19
						Argentina	**0.57**	**-0.40**	**-0.64**
1975-1992	Canada	**0.43**	0.21	-0.32		Brazil	-0.20	**-0.15**	0.14
	France	0.28	0.13	-0.40		Indonesia	**0.32**	0.14	0.11
	Germany	0.12	0.14	0.05		Mexico	-0.01	-0.10	0.03
	Italy	**0.18**	**0.09**	**-0.21**		Peru	0.19	**0.28**	-0.08
	Japan	-0.01	-0.15	-0.18		Philippines	-0.11	0.11	0.18
	UK	0.16	0.11	-0.16		South Korea	**0.31**	**-0.44**	-0.12
	USA	0.05	-0.12	-0.26		Thailand	0.15	-0.18	-0.19
						Turkey	**-0.28**	0.02	0.19
Positive	**G7**	6	5	1					
Negative	**G7**	1	2	6	**Positive**	**Advanced**	10	4	5
Average	**G7**	0.17	0.06	-0.21	**Negative**	**Economies**	3	9	8
		+	+	-	**Average**		0.08	-0.02	-0.05
							+	-	-
					Positive	**Emerging**	5	4	5
					Negative	**Economies**	4	5	4
					Average		0.10	-0.08	-0.04
							+	-	-

Notes. Variables: total inward flows (iTot), total outward flows (oTot); net total flows (noTot), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 3: Correlations with GDP (2)

		iFDI	iFPI	iDebt	oFDI	oFPI	oDebt	noFDI	noFPI	noDebt
1975-2005	Canada	**0.13**	0.02	0.17	**0.11**	0.08	0.11	-0.00	0.03	-0.11
	France	**0.11**	0.17	**0.17**	**0.27**	0.03	0.07	0.27	-0.12	**-0.23**
	Germany	**0.09**	0.00	0.01	-0.01	0.12	-0.01	-0.03	0.05	-0.03
	Italy	0.07	0.04	0.07	0.12	0.06	-0.01	0.10	0.02	**-0.17**
	Japan	-0.02	0.02	-0.05	**0.22**	**-0.25**	-0.08	**0.22**	-0.09	-0.03
	UK	**0.12**	-0.01	0.05	**0.07**	-0.01	0.02	0.01	-0.01	-0.07
	USA	**0.24**	0.12	0.003	0.14	0.04	-0.06	-0.11	-0.05	-0.10
Positive	**G7**	6	6	6	6	5	3	4	3	0
Negative	**G7**	1	1	1	1	2	4	3	4	7
Average	**G7**	0.11	0.05	0.06	0.13	0.01	0.00	0.06	-0.02	-0.11
		+	?/+	+	+	-	?/-	+	?/-	-
1975-1992	Canada	0.09	-0.01	0.35	0.24	-0.25	**0.18**	0.04	-0.11	**-0.26**
	France	0.08	0.07	**0.29**	**0.37**	-0.13	0.16	0.32	-0.15	**-0.36**
	Germany	0.06	-0.07	0.13	0.01	-0.15	**0.12**	0.26	-0.03	0.01
	Italy	-0.05	0.11	**0.18**	-0.03	**0.13**	0.08	0.02	0.07	**-0.24**
	Japan	-0.00	0.30	-0.12	**0.37**	-0.26	-0.15	**0.36**	-0.33	-0.01
	UK	**0.27**	0.07	0.13	**0.31**	-0.12	0.08	0.04	-0.14	-0.12
	USA	0.17	-0.13	0.03	**0.35**	-0.11	-0.17	0.12	0.09	-0.32
Positive	**G7**	5	4	6	6	1	5	7	2	1
Negative	**G7**	2	3	1	1	6	2	0	5	6
Average	**G7**	0.09	0.05	0.14	0.23	-0.13	0.04	0.17	-0.08	-0.18
		+	?/+	+	+	+	+	+	?/-	-

Notes. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt); net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 4: Correlations with GDP (3)

		iFDI	iFPI	iDebt	oFDI	oFPI	oDebt	noFDI	noFPI	noDebt
1992-2005	Canada	**0.21**	0.04	-0.06	0.11	0.27	0.03	-0.04	0.13	0.11
	France	**0.15**	0.24	0.11	0.37	0.06	0.02	0.36	-0.15	-0.20
	Germany	0.16	0.02	-0.06	0.03	**0.27**	-0.12	-0.14	0.10	-0.08
	Italy	0.21	0.04	-0.08	0.23	0.04	**-0.18**	0.18	0.003	-0.12
	Japan	-0.02	-0.12	-0.04	0.07	**-0.26**	-0.06	0.08	0.03	-0.04
	UK	0.11	-0.03	0.02	0.07	0.02	0.004	0.01	0.04	-0.05
	USA	**0.48**	**0.45**	-0.05	-0.01	0.14	0.10	**-0.39**	-0.17	**0.24**
	Denmark	**0.32**	-0.05	0.001	**-0.31**	-0.47	0.04	**-0.31**	-0.37	0.02
	Finland	0.05	0.07	0.03	-0.19	-0.10	0.06	-0.14	-0.08	0.04
	Norway	-0.05	-0.02	-0.06	0.02	-0.15	0.01	0.03	-0.12	0.06
	Portugal	0.14	**-0.36**	**0.28**	-0.10	-0.12	-0.12	-0.10	**0.25**	**-0.20**
	Spain	0.25	**0.21**	0.01	-0.25	-0.23	0.04	-0.26	-0.30	0.01
	Sweden	0.07	0.07	0.02	-0.17	-0.07	0.16	-0.13	-0.12	0.07
	Argentina	0.04	-0.09	**0.55**	-0.26	0.07	**0.42**	-0.08	0.09	**-0.24**
	Brazil	-0.19	-0.28	-0.06	-0.04	**-0.15**	**0.21**	0.09	0.11	0.13
	Indonesia	0.20	0.25	**0.27**	-0.01	0.39	-0.01	0.07	-0.35	0.01
	Mexico	**-0.14**	0.11	0.005	0.36	n.a.	0.16	0.21	n.a.	0.07
	Peru	0.10	**0.23**	0.10	n.a.	0.10	**-0.34**	n.a.	-0.06	-0.21
	Philippines	-0.07	-0.06	-0.10	0.06	0.16	-0.12	-0.03	0.07	0.02
	South Korea	**-0.30**	-0.06	**0.40**	0.18	-0.07	**-0.46**	0.31	0.05	**-0.54**
	Thailand	**-0.45**	**0.20**	**0.19**	-0.17	0.19	**0.20**	0.40	-0.29	-0.10
	Turkey	-0.09	**-0.27**	-0.20	0.07	**-0.22**	**0.23**	0.11	-0.08	**0.28**
Positive	**Advanced**	11	8	7	7	6	9	5	6	7
Negative	**Economies**	2	5	6	6	7	4	8	7	6
Average		0.16	0.04	0.01	-0.01	-0.05	0.00	-0.07	-0.06	-0.01
		+	+	+	-	?/-	-	-	+	?/+
Positive	**Emerging**	3	4	6	4	5	5	6	4	5
Negative	**Economies**	6	5	3	4	3	4	2	4	4
Average		-0.10	0.00	0.13	0.02	0.06	0.03	0.13	-0.06	-0.06
		-	+	+	?	-	+	?/+	?	-

Notes. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt); net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 5: Correlations with Investment-to-GDP Ratio (1)

		iTot	oTot	noTot			iTot	oTot	noTot
1975-2005	Canada	0.21	0.06	**-0.22**	**1992-2005**	Canada	0.04	-0.02	-0.10
	France	**0.17**	0.16	0.01		France	0.20	0.20	0.09
	Germany	0.13	0.10	-0.07		Germany	0.16	0.13	-0.11
	Italy	0.11	0.08	-0.11		Italy	0.05	-0.01	-0.18
	Japan	**0.09**	0.03	-0.12		Japan	0.12	**0.17**	0.11
	UK	-0.02	-0.03	-0.02		UK	-0.10	-0.11	-0.10
	USA	0.12	-0.02	**-0.23**		USA	0.17	0.09	-0.15
						Denmark	0.03	-0.05	0.03
Positive	**G7**	6	5	1		Finland	-0.01	-0.002	0.03
Negative	**G7**	1	2	6		Norway	-0.22	**0.30**	**-0.12**
Average	**G7**	0.12	0.05	-0.11		Portugal	0.10	-0.03	-0.17
		+	?/+	-		Spain	-0.02	-0.12	0.38
						Sweden	-0.17	**0.29**	**-0.24**
						Argentina	0.49	**-0.41**	**-0.59**
1975-1992	Canada	**0.40**	0.18	**-0.32**		Brazil	**0.24**	0.06	**-0.21**
	France	0.17	0.11	-0.15		Indonesia	**0.34**	-0.10	0.19
	Germany	0.10	0.07	-0.03		Mexico	0.15	-0.06	0.06
	Italy	**0.18**	**0.16**	-0.05		Peru	0.07	0.19	0.02
	Japan	0.10	-0.16	**-0.34**		Philippines	-0.03	-0.20	-0.08
	UK	0.10	0.12	0.02		South Korea	**0.34**	**-0.38**	-0.17
	USA	0.09	-0.13	**-0.35**		Thailand	0.18	-0.06	-0.18
						Turkey	0.02	-0.12	-0.08
Positive	**G7**	7	5	1					
Negative	**G7**	0	2	6	**Positive**	**Advanced**	8	6	5
Average	**G7**	0.16	0.05	-0.17	**Negative**	**Economies**	5	7	8
		+	+	-	**Average**		0.03	0.06	-0.04
							?/+	+	-
					Positive	**Emerging**	8	2	3
					Negative	**Economies**	1	7	6
					Average		0.20	-0.12	-0.12
							+	-	-

Notes. Variables: total inward flows (iTot), total outward flows (oTot); net total flows (noTot), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 6: Correlations with Investment-to-GDP Ratio (2)

		iFDI	iFPI	iDebt	oFDI	oFPI	oDebt	noFDI	noFPI	noDebt
1975-2005	Canada	-0.07	0.07	0.22	**0.09**	-0.09	0.06	0.12	-0.11	-0.21
	France	0.07	**0.22**	**0.15**	**0.32**	0.02	0.06	**0.34**	**-0.17**	**-0.21**
	Germany	0.07	-0.01	0.04	0.08	**0.29**	-0.01	0.02	**0.13**	-0.09
	Italy	0.05	-0.02	0.11	0.01	-0.03	0.09	-0.02	-0.00	-0.07
	Japan	-0.03	0.07	0.07	**0.36**	-0.08	0.02	**0.36**	-0.08	-0.10
	UK	**0.14**	0.01	-0.05	0.05	-0.07	-0.02	-0.02	-0.05	0.07
	USA	**0.24**	0.08	0.03	**0.13**	0.02	-0.06	-0.11	-0.04	-0.14
Positive	**G7**	5	5	6	7	3	4	4	1	1
Negative	**G7**	2	2	1	0	4	3	3	6	6
Average	**G7**	0.07	0.06	0.08	0.15	0.01	0.02	0.10	-0.05	-0.11
		+	+	+	+	+	?/+	+	?/-	-
1975-1992	Canada	-0.16	0.03	**0.39**	**0.17**	-0.15	0.16	0.26	-0.09	-0.34
	France	0.01	0.07	**0.21**	**0.43**	-0.07	0.13	**0.42**	-0.10	**-0.22**
	Germany	0.10	-0.03	0.10	0.02	-0.07	0.05	**0.13**	-0.02	-0.05
	Italy	0.13	-0.001	**0.17**	0.07	0.08	**0.15**	-0.07	0.08	-0.06
	Japan	-0.03	0.14	0.04	**0.44**	-0.15	-0.15	**0.43**	-0.16	-0.24
	UK	0.23	-0.15	0.08	**0.29**	-0.01	0.08	0.06	0.05	-0.03
	USA	0.10	**-0.24**	0.11	**0.27**	-0.15	-0.17	0.11	**0.19**	**-0.42**
Positive	**G7**	5	3	7	7	1	5	6	3	0
Negative	**G7**	2	4	0	0	6	2	1	4	7
Average	**G7**	0.05	-0.03	0.16	0.24	-0.07	0.04	0.19	-0.01	-0.19
		?/+	-	+	+	?/-	+	+	+	-

Notes. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt); net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 7: Correlations with Investment-to-GDP Ratio (3)

		iFDI	iFPI	iDebt	oFDI	oFPI	oDebt	noFDI	noFPI	noDebt
1992-2005	Canada	0.01	0.11	0.03	0.09	-0.10	-0.03	0.06	-0.16	-0.07
	France	0.11	**0.31**	0.13	**0.47**	0.04	0.03	**0.49**	**-0.23**	-0.24
	Germany	**0.09**	-0.01	0.03	0.17	**0.46**	-0.06	-0.01	**0.21**	-0.13
	Italy	0.01	-0.03	0.05	0.00	-0.07	0.02	0.00	-0.02	-0.08
	Japan	-0.06	0.02	0.12	**0.24**	-0.07	**0.17**	**0.26**	-0.04	0.10
	UK	**0.15**	0.04	-0.15	0.02	-0.14	-0.09	-0.05	-0.12	**0.17**
	USA	**0.41**	**0.34**	-0.07	0.06	0.08	0.05	**-0.30**	-0.16	**0.21**
	Denmark	0.20	**-0.25**	0.01	-0.10	-0.30	-0.07	-0.14	-0.15	-0.04
	Finland	0.01	-0.11	0.02	-0.01	0.03	0.00	-0.01	0.09	-0.01
	Norway	0.13	0.08	-0.25	0.00	-0.17	**0.34**	-0.04	-0.17	**0.30**
	Portugal	-0.01	**-0.15**	0.15	-0.07	0.01	-0.01	-0.01	0.11	-0.08
	Spain	0.04	-0.06	-0.02	-0.25	-0.23	0.07	-0.17	-0.10	0.05
	Sweden	0.10	-0.06	**-0.27**	0.11	-0.03	**0.39**	-0.04	-0.01	**0.35**
	Argentina	0.12	-0.00	0.40	-0.24	-0.03	**0.44**	-0.16	-0.01	-0.12
	Brazil	-0.03	0.17	**0.23**	-0.10	-0.06	-0.03	-0.00	-0.03	**-0.19**
	Indonesia	**0.32**	0.22	0.27	**0.29**	0.24	0.03	-0.60	0.66	0.09
	Mexico	-0.10	0.08	0.17	-0.37	n.a.	0.23	-0.15	n.a.	-0.02
	Peru	-0.01	-0.21	0.13	n.a.	-0.06	-0.18	n.a.	0.08	-0.18
	Philippines	-0.14	-0.15	0.01	-0.12	0.08	0.21	**0.26**	0.16	0.09
	South Korea	**-0.31**	-0.03	**0.42**	0.17	-0.03	**-0.41**	0.32	0.02	**-0.54**
	Thailand	-0.29	0.06	**0.21**	0.06	0.01	0.06	**0.29**	0.07	**-0.18**
	Turkey	0.03	0.04	0.00	0.25	-0.03	0.18	0.07	-0.04	0.09
Positive	**Advanced**	11	6	8	9	5	8	4	3	6
Negative	**Economies**	2	7	5	4	8	5	9	10	7
Average		0.09	0.02	-0.02	0.06	-0.04	0.06	0.00	-0.06	0.04
		+	?/-	-	+	+	+	+	?/-	+
Positive	**Emerging**	3	5	9	4	3	6	4	5	3
Negative	**Economies**	6	4	0	4	5	3	4	3	6
Average		-0.05	0.02	0.20	-0.01	0.01	0.06	0.00	0.12	-0.11
		?/-	?/+	+	+	?/-	?/+	+	?/+	-

Notes. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt); net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 8: Correlations with Real Interest Rate (1)

		iTot	oTot	noTot			iTot	oTot	noTot
1975-2005	Canada	0.10	0.03	-0.11	**1992-2005**	Canada	-0.15	-0.13	0.04
	France	**0.12**	**0.12**	0.03		France	**0.10**	**0.12**	**0.12**
	Germany	0.07	0.05	-0.06		Germany	0.04	0.04	-0.01
	Italy	**-0.12**	**-0.19**	**-0.19**		Italy	**-0.16**	**-0.19**	-0.05
	Japan	-0.02	-0.09	-0.13		Japan	-0.36	**-0.29**	0.08
	UK	**0.08**	**0.11**	**0.18**		UK	0.16	0.19	**0.26**
	USA	0.04	0.10	0.08		USA	0.10	-0.01	-0.19
						Denmark	0.04	-0.01	-0.11
Positive	**G7**	5	5	3		Finland	-0.03	0.02	0.02
Negative	**G7**	2	2	4		Norway	-0.01	0.09	-0.12
Average	**G7**	0.04	0.02	-0.03		Portugal	0.08	0.06	**-0.27**
		+	+	?/-		Spain	-0.13	**0.23**	**-0.32**
						Sweden	0.07	-0.17	0.19
						Argentina	-0.33	0.09	0.30
1975-1992	Canada	**0.30**	**0.16**	-0.21		Brazil	n.a.	n.a.	n.a.
	France	0.25	**0.15**	-0.29		Indonesia	-0.38	-0.01	0.31
	Germany	**0.18**	**0.08**	-0.10		Mexico	-0.56	0.00	-0.03
	Italy	-0.09	**-0.20**	**-0.26**		Peru	n.a.	n.a.	n.a.
	Japan	0.18	-0.01	-0.31		Philippines	-0.16	-0.18	0.07
	UK	0.07	**0.15**	0.17		South Korea	-0.31	**-0.16**	0.38
	USA	0.00	**0.20**	**0.31**		Thailand	-0.42	-0.20	0.29
						Turkey	0.05	0.25	0.12
Positive	**G7**	6	5	2					
Negative	**G7**	1	2	5	**Positive**	**Advanced**	7	7	6
Average	**G7**	0.13	0.08	-0.10	**Negative**	**Economies**	6	6	7
		+	+	?/-	**Average**		-0.02	0	-0.03
							?/+	?/+	?/-
					Positive	**Emerging**	1	3	6
					Negative	**Economies**	6	4	1
					Average		-0.30	-0.03	0.21
							?/-	-	?/+

Notes. Variables: total inward flows (iTot), total outward flows (oTot); net total flows (noTot), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 9: Correlations with Real Interest Rate (2)

		iFDI	iFPI	iDebt	oFDI	oFPI	oDebt	noFDI	noFPI	noDebt
1975-2005	Canada	-0.04	-0.09	0.11	0.08	-0.004	-0.01	0.09	**0.07**	-0.14
	France	0.00	-0.06	0.07	0.04	-0.06	0.06	0.04	0.01	-0.03
	Germany	0.02	**0.09**	0.05	-0.05	0.01	0.06	-0.04	-0.06	-0.01
	Italy	0.08	0.09	**-0.14**	0.09	**-0.10**	**-0.19**	0.06	**-0.13**	-0.07
	Japan	**0.10**	0.07	-0.05	0.04	**-0.23**	-0.07	-0.01	-0.13	-0.02
	UK	**0.12**	-0.03	**0.08**	-0.02	0.02	**0.12**	-0.07	0.03	**0.15**
	USA	**0.15**	0.15	-0.04	-0.10	-0.02	**0.13**	**-0.18**	**-0.12**	**0.28**
Positive	**G7**	6	4	4	4	2	4	3	3	2
Negative	**G7**	1	3	3	3	5	3	4	4	5
Average	**G7**	0.06	0.03	0.01	0.01	-0.05	0.02	-0.02	-0.05	0.02
		+	+	?/+	?/+	-	+	-	-	+
1975-1992	Canada	-0.13	-0.14	**0.33**	0.16	-0.28	**0.16**	0.23	-0.02	**-0.25**
	France	0.02	0.03	0.05	**0.26**	**-0.21**	-0.01	**0.25**	-0.19	-0.15
	Germany	-0.01	0.08	**0.17**	-0.05	**-0.25**	**0.09**	**0.13**	**-0.20**	-0.07
	Italy	0.05	0.04	-0.10	0.02	0.04	**-0.21**	-0.04	0.02	**-0.26**
	Japan	0.13	**0.33**	0.05	-0.005	**-0.26**	0.04	-0.02	**-0.35**	-0.03
	UK	0.19	-0.15	0.06	-0.07	**0.27**	0.12	-0.20	**0.32**	0.11
	USA	**0.20**	0.01	-0.04	0.06	0.01	**0.18**	-0.09	-0.01	**0.34**
Positive	**G7**	5	5	5	4	3	5	3	2	2
Positive	**G7**	2	2	2	3	4	2	4	5	5
Positive	**G7**	0.06	0.03	0.07	0.05	-0.10	0.05	0.04	-0.06	-0.05
		+	+	+	+	-	+	+	-	-

Notes. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt); net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 10: Correlations with Real Interest Rate (3)

		iFDI	iFPI	iDebt	oFDI	oFPI	oDebt	noFDI	noFPI	noDebt
1992-2005	Canada	0.09	-0.11	**-0.25**	0.10	0.15	**-0.27**	0.03	**0.19**	0.01
	France	-0.01	-0.08	**0.12**	0.02	-0.05	**0.14**	0.02	0.03	0.05
	Germany	0.04	0.16	0.01	-0.10	0.09	0.05	**-0.12**	-0.08	0.05
	Italy	0.13	**0.15**	**-0.20**	0.16	-0.20	**-0.16**	0.13	**-0.26**	**0.13**
	Japan	**0.23**	**-0.25**	**-0.26**	0.13	**-0.38**	**-0.27**	-0.03	0.12	-0.01
	UK	**0.17**	-0.04	0.16	-0.03	**-0.12**	**0.24**	-0.10	-0.05	**0.30**
	USA	0.20	0.32	-0.05	**-0.29**	-0.05	0.09	**-0.32**	**-0.24**	**0.23**
	Denmark	-0.02	0.19	-0.01	0.04	-0.31	0.00	0.03	-0.31	0.01
	Finland	-0.06	-0.14	0.04	0.10	0.06	-0.06	0.09	0.13	-0.05
	Norway	0.00	**-0.26**	0.03	0.04	0.21	0.01	0.01	0.28	0.03
	Portugal	-0.05	-0.03	**0.10**	-0.07	0.22	0.07	-0.02	0.11	-0.03
	Spain	-0.15	-0.03	-0.07	**0.27**	**0.22**	0.06	**0.27**	**0.17**	0.06
	Sweden	-0.00	-0.04	0.10	-0.19	0.04	-0.18	-0.08	0.06	-0.15
	Argentina	-0.12	0.06	-0.27	**0.29**	-0.12	-0.12	**0.17**	-0.07	0.19
	Brazil	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Indonesia	-0.10	-0.46	-0.16	0.29	-0.25	0.01	-0.31	0.19	0.15
	Mexico	0.08	-0.25	-0.55	-0.01	n.a.	0.04	0.12	n.a.	0.43
	Peru	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Philippines	0.01	-0.40	-0.13	**-0.19**	0.14	0.19	-0.12	0.43	0.18
	South Korea	**-0.19**	-0.06	-0.29	**0.38**	0.04	**-0.23**	**0.31**	0.07	0.16
	Thailand	0.18	0.24	-0.47	0.18	0.31	0.18	-0.13	-0.44	0.52
	Turkey	-0.10	-0.10	**0.14**	**0.35**	-0.02	**-0.49**	0.21	0.03	**-0.37**
Positive	**Advanced**	7	4	7	8	7	8	7	8	9
Negative	**Economies**	6	9	6	5	6	5	6	5	4
Average		0.05	-0.01	-0.02	0.01	-0.01	-0.02	-0.01	0.01	0.05
		+	-	-	?/+	-	-	-	?/+	+
Positive	**Emerging**	3	2	1	5	3	4	4	4	6
Negative	**Economies**	4	5	6	2	3	3	3	2	1
Average		-0.03	-0.14	-0.25	0.18	0.02	-0.06	0.04	0.04	0.18
		-	?/-	+	+	?	-	+	?/+	-

Notes. Variables: inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt); net FDI (noFDI), net FPI (noFPI), net Debt (noDebt), defined as outward flows net of inward flows. To designate a particular flow procyclical (a plus sign in the tables), countercyclical (a minus sign), or uncertain (a question mark) over the sample and with respect to a reference macroeconomic variable, we used a simple rule of thumb described in subsection 4.2.2. Bold-face text indicates that the estimates are significant at the 10 percent confidence level.

Table 11: Changes in Second Moments. Breaks Based on Episodes of Capital Account Liberalization (Method I)

	iToT, g	oToT, g	noTot, g	iFDI, g	iFPI, g	iDebt, g	oFDI, g	oFPI, g	oDebt, g
Japan	d-d-u-u	u-d-U-u	u-u-u-u	D-d-U-u	d-d-U-u	u-u-U-u	d-d-u-u	d-d-U-u	u-u-U-u
France	d-d-u-u	u-u-u-u	u-u-u-u	d-u-U-u	d-u-u-u	d-d-U-u	u-u-U-u	u-u-u-u	d-d-u-u
Germany	u-d-D-d	U-U-u-d	U-U-d-d	d-d-U-d	u-u-U-d	u-d-D-d	d-u-U-d	u-u-U-d	u-u-u-d
Italy	D-D-u-d	D-D-u-d	u-U-d-d	u-u-u-d	d-u-U-d	D-D-u-d	u-u-U-d	d-u-u-d	D-D-d-d
UK	d-d-u-D	d-d-u-D	u-u-u-D	d-d-u-D	u-u-u-D	d-d-u-D	D-d-u-D	u-u-U-D	d-d-u-D
USA	u-u-u-u	d-u-u-u	d-d-u-u	u-u-u-u	d-d-U-u	u-u-U-u	u-u-u-u	u-d-U-u	d-u-u-u
Canada	-	-	-	-	-	-	-	-	-

	iToT, ι	oToT, ι	noTot, ι	iToT, r	oToT, r	noTot, r
Japan	u-d-u-D	U-U-U-D	U-U-u-D	U-U-u-D	D-d-U-D	u-u-u-D
France	d-d-u-d	d-d-u-d	d-d-u-d	u-u-u-d	u-u-u-d	u-u-u-d
Germany	u-d-D-d	u-u-u-d	u-u-d-d	d-d-D-u	u-u-u-u	U-U-d-u
Italy	d-d-u-u	D-D-u-u	d-d-d-u	d-d-u-d	d-u-u-d	u-U-d-d
UK	d-D-u-u	d-d-u-u	u-u-u-u	u-u-u-d	u-u-u-d	D-d-u-d
USA	d-d-u-u	d-d-u-u	u-d-u-u	u-u-u-d	d-d-u-d	u-d-u-d
Canada	-	-	-	-	-	-

Table 12: Changes in Second Moments. Breaks in the Conditional Variance (Method II)

	iToT, g	oToT, g	noTot, g	iFDI, g	iFPI, g	iDebt, g	oFDI, g	oFPI, g	oDebt, g
Japan	u-u-u-u	u-u-U-u	d-d-u-d	d-d-U-d	D-D-U-d	u-u-U-d	d-d-u-d	u-u-U-u	u-u-U-u
France	d-u-U-d	u-u-U-d	U-U-U-d	u-u-U-d	u-u-U-d	d-d-U-d	u-u-U-d	u-u-U-d	d-d-U-d
Germany	u-u-U-D	u-u-U-D	d-d-U-D	u-u-U-D	u-u-U-D	u-u-U-D	u-u-U-D	u-u-U-D	u-u-U-D
Italy	d-d-U-D	d-D-d-d	u-u-D-d	U-u-U-D	u-u-U-D	D-d-U-D	U-u-U-D	u-u-U-D	d-D-d-d
UK	u-u-U-D	u-u-U-D	u-u-D-D	u-u-U-D	u-u-U-D	u-u-U-D	d-u-U-D	u-u-U-D	u-u-U-D
USA	U-u-U-d	U-U-U-D	d-d-U-d	U-U-U-d	U-U-U-d	d-d-U-d	d-d-U-d	U-U-U-d	U-U-U-d
Canada	d-d-U-D	u-u-U-D	u-u-D-D	u-u-U-D	u-u-u-D	D-D-U-D	u-u-U-D	U-U-U-D	D-D-U-D

	iToT, ι	oToT, ι	noTot, ι	iToT, r	oToT, r	noTot, r
Japan	u-d-u-D	U-U-U-D	U-U-u-D	u-U-u-D	D-D-U-D	u-u-u-D
France	u-u-U-d	u-U-U-d	U-U-U-d	D-d-U-D	d-d-U-D	u-u-U-D
Germany	u-u-U-u	u-U-U-d	d-d-U-u	d-D-U-D	d-d-U-D	U-U-U-D
Italy	d-d-U-d	D-d-d-u	d-d-D-u	u-u-U-D	d-d-d-D	u-U-D-d
UK	d-d-U-D	d-d-U-D	d-d-D-d	u-u-U-D	u-u-U-D	d-d-D-D
USA	u-u-U-d	U-U-U-d	u-u-U-d	u-u-U-d	d-D-U-d	D-D-U-d
Canada	D-d-U-d	D-d-U-D	u-U-D-D	d-d-U-D	d-d-U-D	u-u-D-D

Notes. Changes in second moments are computed over the period 1975:Q1-2005:Q4 and reported in the following order: correlation change, covariance change, variance change in the cyclical component of the capital flow, variance change in the macroeconomic variable. g: Real GDP, ι: Investment-to-GDP Ratio, r: Real interest rate. u: non-significantly positive change in the second moment, U: significantly positive change in the second moment, d: non-significantly negative change in the second moment, D: significantly negative change in the second moment. Capital flows: total inward flows (iTot), total outward flows (oTot); net total flows (noTot), defined as outward flows net of inward flows; inward FDI (iFDI), inward FPI (iFPI), inward Debt (iDebt); outward FDI (oFDI), outward FPI (oFPI), outward Debt (oDebt).

Figure 1: Disaggregated Flows: Recursive Correlations with GDP, from reported date to 2005

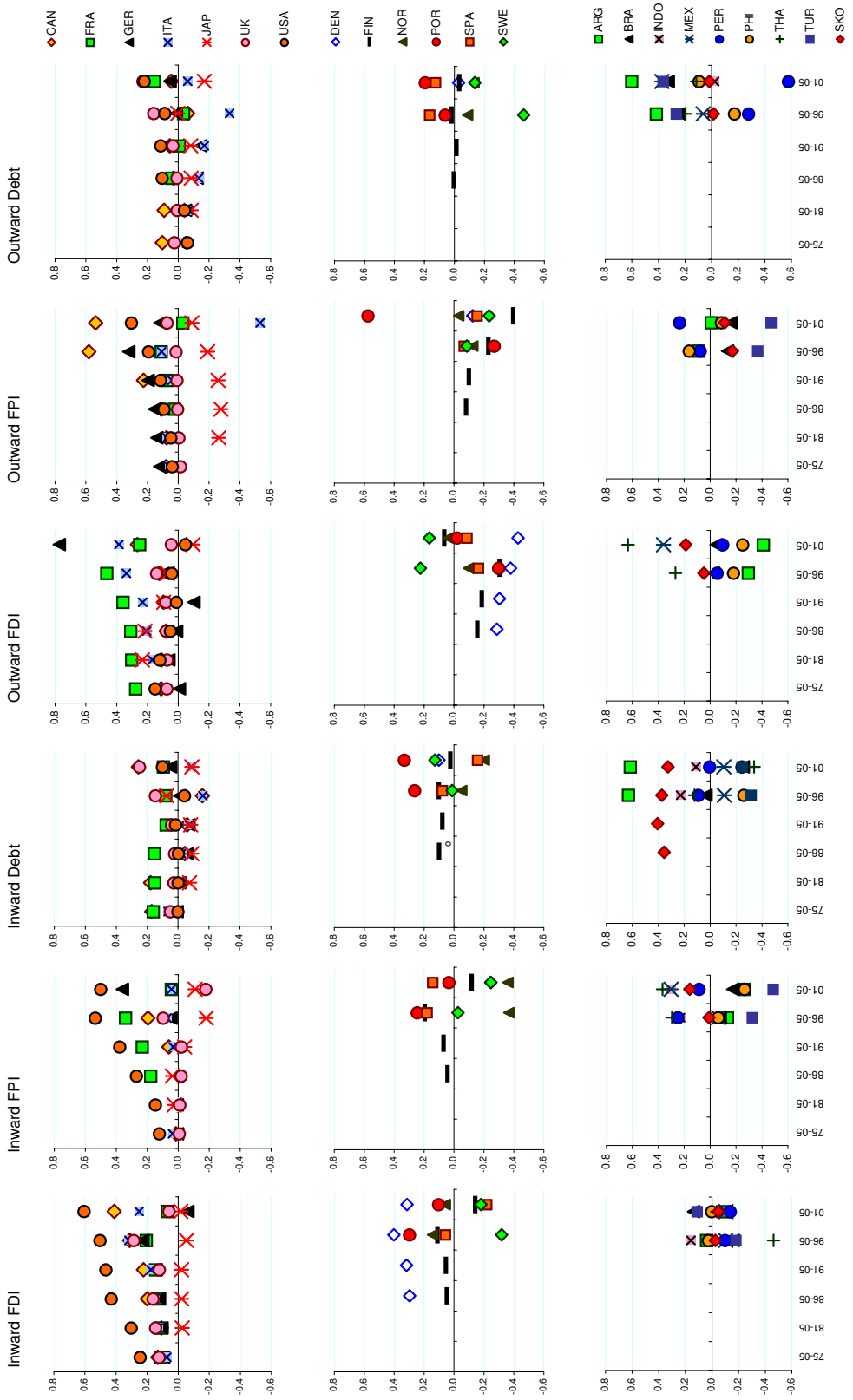
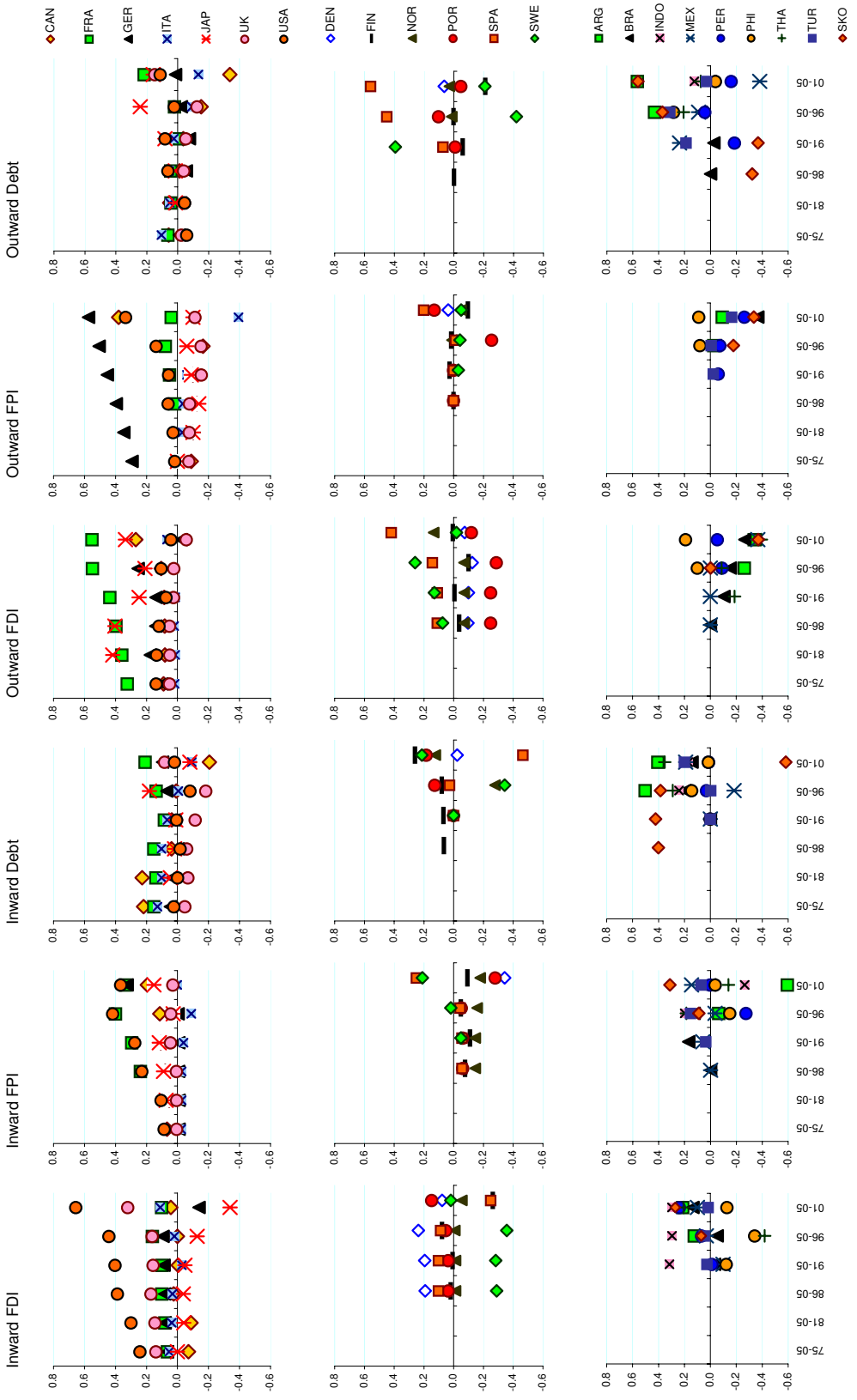


Figure 2: Disaggregated Flows: Recursive Correlations with Investment-to-GDP Ratio, from reported date to 2005



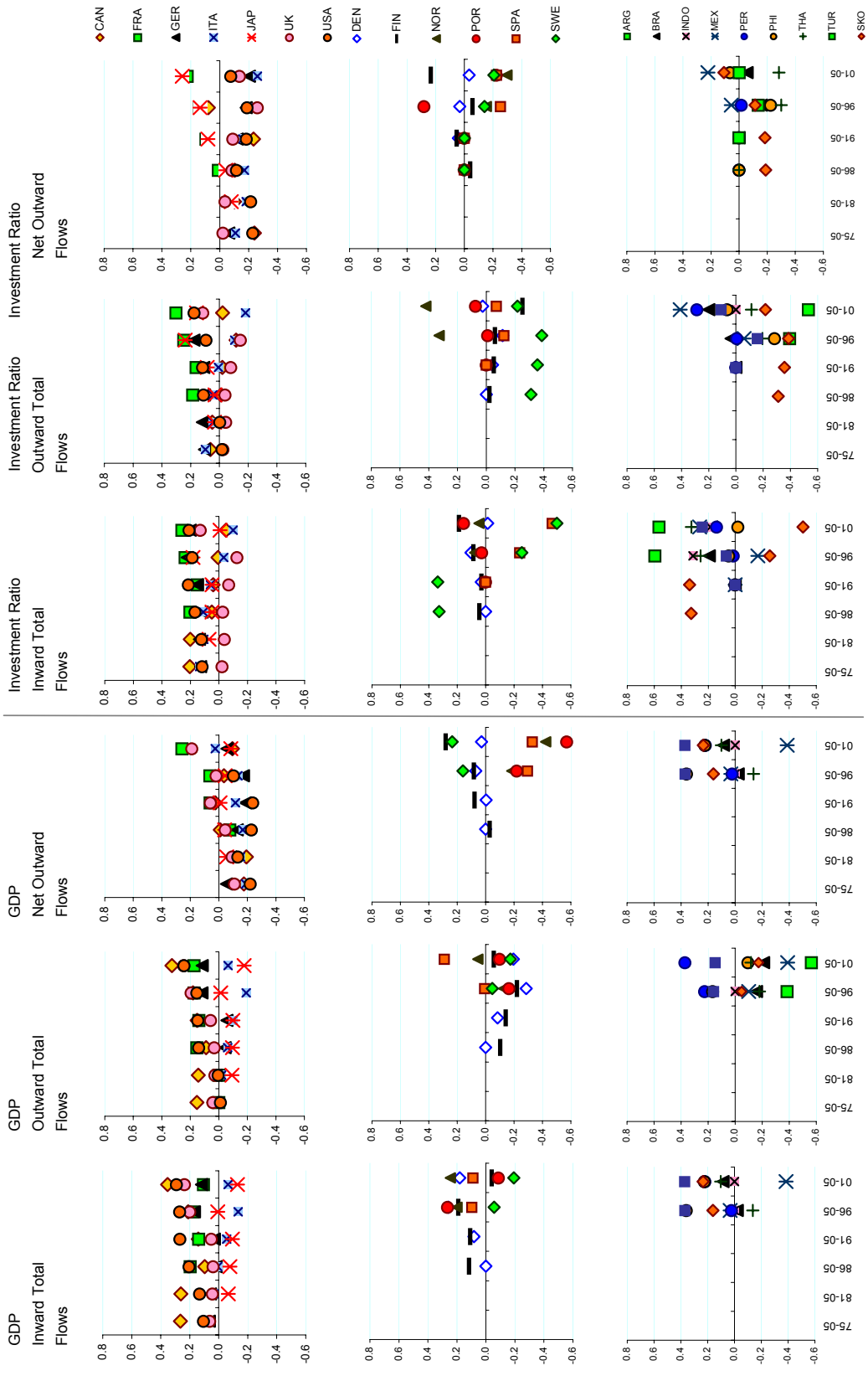


Figure 3: Aggregate Flows: Recursive Correlations with GDP (left panel) and Investment-to-GDP Ratio (right panel), from reported date to 2005